Research Article

Non-operative Management (NOM) of Blunt Abdominal Trauma (BAT): A Tertiary Care University Hospital Study

Shashi Prakash Mishra[1], Sumit Sharma[1], Mumtaz A. Ansari[2] and Vivek Srivastava[2]*

[1]Department of General Surgery, Trauma and Superspecialty Hospital, Institute of Medical Sciences, Banaras Hindu University, Varanasi, UP, India; [2]Department of General Surgery, Institute of Medical Sciences, Banaras Hindu University, Varanasi, UP, India

Corresponding author:
Dr. Vivek Srivastava, Associate Professor, Department of General Surgery, Institute of Medical Sciences, Banaras Hindu University, Varanasi-221005, UP, India,
Tel: +919453792147;
E-mail: viveksurgbhu97@gmail.com

Abstract

Background: NOM is considered a treatment option for all hemodynamically stable patients without peritoneal signs and many recent reports reveal success rates of 80%. In this study we evaluated the feasibility and safety of NOM of BAT in our hospital. **Methods:** This retrospective study comprises 86 patients with BAT who were admitted over a 3 year period. NOM was applied in 82.93% (34 patients) of all BATs with a failure rate of 17.07% (7 patients). Of these 7 patients of NOM failure were clubbed with OM group in order to perform statistical comparison. Finally comparison was done between NOM (n=64) and OM (n=22) group. The comparison was done between NOM and OM group in terms of demographic, medical history (co-morbidities), mode of injury, hemodynamic status, and organs injured, injury grading, length of hospital stay, morbidity and mortality. **Results:** Most of the patients were young adults (20-45 years) with mean age being 32.45 years and age ranging between 16-62 years. The commonest cause of BAT (n=78, 90.69%) was Road traffic accident (RTA). No significant differences were observed between NOM and OM group in relation with age, sex, time of presentation (hours), co-morbidities and mechanism of injury. Injury severity score (ISS), hematocrit, hemodynamic status and blood transfusion were significantly different between NOM and operative group. NOM has a significant decrease in length of hospital stay, ICU admission and morbidity compared to patients who underwent surgery. NOM failure occurred in 4 patients with splenic injury and 1 patient with liver injury and 2 patients with hollow viscous perforation.6 patients were died in OM group. The success rate of NOM was 95.3%. **Conclusion:** NOM for BAT was found to be highly successful and safe. The patient with hemodynamically stable or easily stabilized trauma may be admitted to a non-ICU unit, with close monitoring of vital signs and regular clinical examinations.

Keywords: Blunt abdominal trauma; Non-operative management; Operative management

Introduction

Abdomen is the area most commonly injured after the head and the extremities. [1,2] Injuries can be in the nature of BAT, stab wounds or gunshot wounds. BAT constitutes 5-15% of all operative abdominal injuries [3] and it accounts for about 90% of abdominal injuries. [4] The majority of BAT is seen after motor vehicle accidents. The approach to abdominal trauma has changed substantially in the last 2 decades. With the introduction of better intensive care, radiological intervention and trauma protocols, NOM is considered a standard of care for all hemodynamically stable patients with no peritoneal signs and several studies indicate success rates above 80%. [5,6] The success rate of NOM for liver and renal injuries is even higher, approaching 90%. [7,8]. In contrast, NOM is still minimal and problematic in pancreatic trauma. [7] Many NOM studies were planned and performed in specialist hospitals with dedicated human resources, surgical/trauma ICU, and comprehensive minimally invasive or endoscopic facilities. This retrospective study was carried out in a tertiary care teaching hospital to evaluate the feasibility and safety of NOM of BAT patients.

Research Methodology

Records of patients treated with blunt abdominal injury to our Trauma Center and Multispeciality Hospital of Institute of Medical Sciences, Banaras Hindu University, Varanasi form January 2016 to December 2019 were retrospectively analyzed. The study was approved by the Institute Ethical Committee of the Institute. The written informed consents were taken from all the patients or his/her relatives. All patients were initially

How to Cite this Article: Mishra SP, et al. Non-operative Management (NOM) of Blunt Abdominal Trauma (BAT): A Tertiary Care University Hospital Study. Ann Med Health Sci Res. 2020;10: 877-881.

assessed and resuscitated at the emergency room (ER) according to the advanced trauma life support (ATLS) guidelines.

Patients were defined as hemodynamically stable or unstable following resuscitation according to their systolic blood pressure (SBP), heart rate (HR), respiratory rate (RR), and hematocrit. All unstable patients were moved into the operation theatre immediately. Such patients who were hemodynamically and clinically stable following resuscitation were further examined. Regular ultrasound was conducted in all cases, while abdominal and pelvis CT scans were done only in those with ultrasound diagnostic issues. Patients who died in ER during the resuscitation process have been excluded from the study. All patients who were hemodynamically and clinically stable after resuscitation were recruited for group NOM. These patients were admitted to surgical ICU and regularly underwent physical examination with hematocrit. Whenever in doubt, ultrasound and CT scans were repeated. Those deteriorating patients were taken up for surgery and were called the Operative Management (OM) group. The unit's surgeon took a decision to operate on cases that had been held under the NOM group.

The NOM was performed in 82.6% (n=71) of all BATs with a 9.9% failure rate (n=7). NOM failure was occurred in 4 patients with splenic injury, 1 patient with liver injury and 2 patients with hollow viscous perforation. Due to small sample size (n = 7) of NOM failure they were clubbed with operative management (OM) group in order to perform statistical comparison. The comparison was done between NOM (n=64) and OM (n=22) group in terms of demographic and outcome data.

Data recorded were age, sex, medical history (co-morbidities), mode of injury, hemodynamic status, organs injured, injury grading, length of hospital stay, morbidity and mortality. Trauma severity was evaluated according to Injury Severity Score (ISS) and Injury Scaling and Scoring System [AAST Injury Scaling and Scoring System]. Abdominal injuries (isolated or multiple) and severe extra-abdominal injuries were also recorded.

Data were evaluated using SPSS 23.0 for windows (IBM Inc., USA). Comparison was done between NOM and OM group in terms of demographic, trauma characteristics and outcome data. For categorical variables Chi Square Test and Fischer Exact Test were used. For continuous variable Student's 't' test was used. $p<0.05$ were considered to be statistically significant.

Results

During the three year period from January 2016 to December 2019, a total of 86 patients were evaluated for BAT. NOM was initially applied in 82.6% (71 patients) of all BATs with a failure rate of 9.9% (7 patients). NOM failure occurred in 4 patients with splenic injury, 1 patient with liver injury and 2 patients with hollow viscous perforation. Of these 7 patients of NOM failure were clubbed with OM group in order to perform statistical comparison. Finally comparison was done between NOM (n=64) and OM (n=22) group. There were 69 (80.23%) male and 17 (19.76%) female. Most of the patients were young adults (20-45 years) with mean age being 32.45 years and age ranging between 16-62 years. The commonest cause of blunt abdominal trauma (n=78, 90.69%) was Road traffic accident (RTA). No significant differences were observed between NOM and OM group in relation with age, sex, time of presentation (hours), co-morbidities and mechanism of injury (road traffic accident) [Table 1].

The mean ISS in NOM group was 19.5 33.23 ± 1.33 and OM group was 41.74 ± 2.89. In OM group, the mean ISS was significantly higher as compared to NOM group because of unstable or multiple injury patients were more in OM group. In these patients, the mean hematocrit at admission was significantly low (p=0.002) and mean blood transfusion was significantly high (p=0.004) [Table 2]. There was no significant difference between the two groups in terms of FAST positivity (p=0.166). In NOM group, pulse rate <110/min and SBP >90 mmHg were significantly more cases in NOM group as compared to OM group ($p<0.001$ and $p<0.001$).

On comparing injury characteristics, no significant difference was noted between the NOM and the OM group in relation to the liver, kidney, peritonism and extra abdominal injury respectively (p=0.677, 0.168, 0.126 and 0.779). The splenic injury was significantly more in OM group as compared to NOM group (59.1% vs. 32.8%, p=0.029). In NOM group, 2

Table 1: Demographic characteristics between NOM and OM groups.

Variables	NOM Group (n=64)	OM Group (n=22)	p-value
Age, years (Mean ± SD)	33.45 ± 12.23	31.57 ± 13.39	0.545
Male Sex, No. (%)	51 (79.7%)	18 (81.8%)	0.828
Time of presentation (hours)	16.45 ± 3.54	17.88 ± 3.78	0.111
Co-morbidities, No. (%)	17 (26.6%)	6 (27.3%)	0.948
Road Traffic Accident, No. (%)	58 (90.6%)	20 (90.9%)	0.968

Table 2: Presentation characteristics between NOM and OM groups.

Variables	NOM Group (n=64)	OM Group (n=22)	p-value
ISS (mean ± SD)	33.23 ± 1.33	41.74 ± 2.89	0.003
Hematocrit at Admission (Mean ± SD)	36.46 ± 2.21	23.67 ± 2.52	0.002
SBP >90 mmHg	61 (95.3%)	3 (13.6%)	<0.001
Pulse Rate <110/min	63 (98.4%)	3 (13.6%)	<0.001
No. of FAST positivity	56 (87.5%)	22 (100%)	0.166
Blood Transfusion (mean ± SD)	2.36 ± 0.56	5.85 ± 1.22	0.004

cases of hollow viscous perforation in comparison to OM group (3.1% vs. 22.7%, p=0.001) [Table 3].

The OM had an ICU admission rate of 36.4% (n=8), with a longer period of hospitalization (15.0 ± 3.0 days) and higher morbidity (27.3%) in comparison to the NOM with an ICU admission rate of 9.4%, length of stay (6.0 ± 2.0 days) and morbidity of (4.7%). In NOM group, all the patients were discharged as compared 16 patients were discharged and 6 (27.3%) patients were died in OM group [Table 4].

Of these 6 died patients, 3 were male and 2 were female. Four of them had splenic injury (grade IV) and finally underwent laparotomy (on the 4th post-admission day) due to hemodynamic instability and very low average hematocrit at admission and 2 patients with hollow viscous perforation (grade III) also underwent laparotomy on post-admission day 4 due to hemodynamic instability and occult laceration.

Discussion

For many cases, NOM for BAT is becoming the standard treatment over the last few decades, particularly for stable patients with liver, spleen, or kidney injuries. [9-11] This has been well known, and hemodynamic stability-based approaches and findings of CT scan are now widely used. Also patients with hemo-peritoneum, altered mental state, higher injury grades and older ages have now been regularly treated non-operationally in several well-established centers with few failures, [12] but it also becomes a concern in a hospital where resources are minimal. Therefore, emergency room teams need to include or work closely with general surgeons in order to carry out an objective evaluation of abdominal injuries and to delineate the need for emergency laparotomy or NOM. [13]

Age, sex, presentation time, and patient comorbidities have had no influence on the outcome in this research. Most patients were male and the maximum number of patients was in the 20to 45-year age range. The mean age was 32.5 years. The most common mode of injury was due to RTA, which is similarly stated by John et al. [14] and Giannopoulos et al. [15] in their studies.

If the decision to observe the patient and follow non-operational treatment has been taken, careful monitoring of vital signs and regularly repeated physical exams should be implemented. Laboratory tests, such as the count of white blood cells, hemoglobin and hematocrit, and the levels of serum lactic acid and base deficit can also help to determine whether the non-operational technique fails. An indication for surgery is the occurrence of peritonitis on physical examination and lack of response to non-operational management. Hemodynamic condition, hematocrit admission, transfusion requirement and ISS were significantly different between OM and NOM group in the present study. Some reports suggest that these characteristics are significant predictors of NOM success, similar to Giannopoulos et al. [15] and Ghimire et al. [16] studies.

Most authors agree the associated organ is significant, even crucial in the success of NOMs. In the present study, there was no significant difference in liver, kidney, peritonism and extra abdominal injury (p=0.677, p=0.168, p=0.126, and p=0.779 respectively) between the NOM and the OM group. In the OM group, the splenic injury was significantly higher than in the NOM group (59.1% vs. 32.8% p=0.029). Two cases of hollow viscous perforation in the NOM group as compared to the OM group (3.1% vs. 22.7%, p=0.003). A study carried out by Giannopoulos et al. [15] showed similar findings.

The blunt nonsplenic injury was established as an independent prognostic factor. In addition, it is reported that splenic trauma has the highest rate of failure, reaching 30%. [6,17] Yanar et al. [6] report that 50% of cases of failure were spleen-related. In our study, splenic injury was present in the OM group in a significantly higher number of cases (59.1%) than in the NOM group (32.8%). All the cases of splenic injury in NOM group was Grade I and II whereas there were 9 and 4 cases of Grade II and III splenic injury in the OM group. In addition, 4 of 7 (57.14%) NOM failure cases were splenic injuries. In a study conducted by Giannopoulos et al. [15] it was found that splenic trauma was present in the OM group in 75% of cases and that splenic injuries were 66.6% (2/3) cases of NOM failure. Evidence indicates that even very severe splenic injuries, associated with substantial hemoperitoneum, have been treated successfully without surgery. [18] In 80-90% of cases, splenic

Table 3: Injury characteristics between NOM and OM groups.

Variables	NOM Group (n=64)	OM Group (n=22)	NOM failure group (n=7)	p-value*
Liver injury	41 (64.1%)	13 (59.1%)	1 (14.29%)	0.677
Splenic injury	21 (32.8%)	13 (59.1%)	4 (57.14%)	0.029
Kidney injury	7 (10.9%)	5 (22.7%)	0	0.168
Hollow viscous perforation	2 (3.1%)	5 (22.7%)	2 (28.57%)	0.003
Peritonism	0	2 (9.1%)	0	0.126
Extra-abdominal injury	54 (84.4%)	18 (81.8%)	0	0.779

* Comparison between NOM and OM group

Table 4: Outcome measures.

Variables	NOM Group (n=64)	OM Group (n=22)	p-value
ICU admission, No. (%)	6 (9.4%)	8 (36.4%)	0.003
Length of stay, days (Mean ± SD)	6.0 ± 2.0	15.0 ± 3.0	<0.001
Morbidity, No. (%)	3 (4.7%)	6 (27.3%)	0.001
Mortality, No. (%)	0	6 (27.3%)	<0.001

injury that rapidly stabilizes with little fluid or blood replacement is successful [8].

In 3–5% of cases of BAT, hollow viscus injuries occur. [19] A possible downside of NOM is the lack of hollow viscus injuries. Swaid et al. [20] observed that hollow viscus injury (neither splenic nor hepatic) in BAT, isolated BSI, isolated BHI and concomitant BHSI rate was 1.5%, 3.1%, 3.1% and 6.7%, respectively. The complicated and nonspecific appearance of hollow viscus injury requires complicated initial evaluation, and a repeat CT scan may be required to detect occult laceration. [21] MDCT has been promoted as a more sensitive tool for detecting hollow viscus injury. However, even after using this much more comprehensive imaging method, Ekeh et al. [22] reported a detection failure rate of 19.3% for hollow viscus injury. In our study, the hollow viscus injury in the OM group was significantly higher than in the NOM group (22.7% vs. 3.1% p=0.003). All these cases of hollow viscus injury in NOM group were NOM failure due to occult laceration.

In cases of liver injury, conversion rate was low with good outcome and hence, liver is the safest organ that can be treated conservatively after a blunt trauma. In our study, liver was injured in 64.1% of cases of NOM and 59.1% of OM group in this study (p=0.677). One case of NOM failure in our sample was due to hemodynamic instability and hepatic laceration. While the main concern does not seem to be bleeding-related mortality, some authors emphasize that hepatic injuries of grade IV and V are frequently associated with high morbidity. Most complications such as recurrent bleeding, biloma, bile peritonitis, abscess, or fistulae may be treated successfully with numerous noninvasive procedures. [8,23]

Moreover, NOM was also used in kidney injury. NOM of renal trauma has become standard. If the injury is accurately staged, in the hemodynamically stable patient, NOM is effective for contusions, contained lacerations, and even lesions with small amount of urine or blood extravasation.

In our study, liver was injured in 10.9% cases in NOM group and 22.7% cases of OM group (p=0.168), and there was no case of NOM failure. Similar results were found in studies conducted by Giannopoulos et al. [15] and Ghimire et al. [16]

In the present study, extra-abdominal injury demonstrated a significant difference between OM and NOM group, but none of case present in any NOM failure. While the multiplicity of injury has historically been correlated with higher rates of failure, recent studies show contradictory results [6]. Shortage of certain aids, such as ICU beds, can encourage a “preventive” procedure. Nevertheless, the proportion of NOM group patients stayed on the ward in the current series under close observation and remained in the ICU where his grade II splenic injury was handled with conservativeness. Studies conducted by Giannopoulos et al. [15] and Bala et al. [24] recorded similar findings.

In our study, an ICU admission rate was significantly high in OM group as compared to NOM group (36.4% vs. 9.4%, p=0.003). The mean duration of hospitalization in OM was 15.0 ± 3.0 days and NOM group was 6.0 ± 2.0 days. Although this is statistically significant (p<0.001), the cause for the long stay in the OM group was primarily because of their related injuries and not because of the blunt abdominal injury per se. Our results show an initial non-operational therapy rate of 82.6% for patients with BAT, with an estimated success rate of 95.3%.

These findings correlate favorably with similar results reported by Raza et al, [11] whose study also describes an initial NOM rate of 80%, with a success rate of 90% and study by Ghimire et al. [16] found a success rate of 97%. Morbidity in the OM group was significantly high, and mortality in the OM group was also higher than in the NOM group (p=0.001 and p<0.001 respectively) in our study.

In OM group 6 patients were died, 3 were male and 2 were female. Four of them had splenic injury and finally underwent laparotomy (on the 4th post-admission day) due to hemodynamic instability and very low average hematocrit at admission and 2 patients with hollow viscous perforation (grade III) also underwent laparotomy on post-admission day 4 due to hemodynamic instability and occult laceration.

Conclusion

NOM for BAT was found to be highly successful and safe. The hemodynamically stable or easily stabilized trauma patient can be admitted in a non-ICU ward with the provision of close monitoring of vital signs and repeated clinical examinations. Splenic, liver and missed bowel injury carries high risk for NOM failure. Morbidity and mortality is directly related to type of management done in BTA.

Competing Interests

The authors declare that they have no competing interests.

References

1. Wiewióra M, Sosada K, Piecuch J, Zurawiński W. The role of laparoscopy in abdominal trauma – A review of the literature. WideochirInne Tech Malo Inwazyjne. 2011;6:121-126.
2. Soreide K. Epidemiology of major trauma. Br J Surg. 2009;96:697-698.
3. Keller MS. Blunt injury to solid abdominal organs. Semin Pediatr Surg. 2004;13:10611.
4. Leung E, Wong L, Taylor J. Non-operative management for blunt splenic trauma in children: An updated literature review. Surgical Practice. 2007;11:29-35.
5. Haan JM, Bochicchio GV, Kramer N, Scalea TM. Nonoperative management of blunt splenic injury: a 5-year experience. J Trauma. 2005;58:492-498.
6. Yanar H, Ertekin C, Taviloglu K, Kabay B, Bakkaloglu H, Guloglu R. Nonoperative treatment of multiple intra-abdominal solid organ injury after blunt abdominal trauma. J Trauma. 2008;64:943-948.
7. Schroeppel TJ, Croce MA. Diagnosis and management of blunt abdominal solid organ injury. Curr Opin Crit Care. 2007;13:399-404.
8. Velmahos GC, Toutouzas KG, Radin R, Chan L, Demetriades D. Nonoperative treatment of blunt injury to solid abdominal organs: a prospective study. Arch Surg. 2003;138:844-851.
9. Ozoğul B, Kısaoğlu A, Aydınlı B, Oztürk G, Bayramoğlu A, Sarıtemur M, et al. Non-operative management (NOM) of blunt hepatic trauma: 80 cases. Ulus Travma Acil Cerrahi Derg. 2014;20:97-100.

10. Cirocchi R, Corsi A, Castellani E, Barberini F, Renzi C, Cagini L, et al. Case series of non-operative management vs. operative management of splenic injury after blunt trauma. Ulus Travma Acil Cerrahi Derg. 2014;20:91-96.

11. Raza M, Abbas Y, Devi V, Prasad KV, Rizk KN, Nair PP. Non operative management of abdominal trauma – a 10 years review. World J Emerg Surg 2013;8:14.

12. Schwab CW. Selection of non-operative management candidates. World J Surg. 2001;25:1389-1392.

13. Klar E, German Society of Trauma Surgery. Surgical expertise in the management of abdominal injuries from the perspective of general and GI surgery. Reality of care at a level-1 trauma centre. Unfallchirurg. 2012;115:35-37.

14. John S, Chandru R, Ramakrishnan R. Evaluation of the outcome of non-operative management in blunt abdominal solid organ injury. Int Surg J. 2016;3:626-632.

15. Giannopoulos GA, Katsoulis IE, Tzanakis NE, Patsaouras PA, Digalakis MK. Non-operative management of blunt abdominal trauma. Is it safe and feasible in a district general hospital? Scand J Trauma Resusc Emerg Med. 2009;17:22.

16. Ghimire P, Yogi N, Ghimire P. Non-operative Management of Blunt abdominal trauma in a Tertiary Care Hospital of a Developing Nation. Nepal Journal of Medical Sciences. 2013;2:38-41.

17. Cadeddu M, Garnett A, Al-Anezi K, Farrokhyar F. Management of spleen injuries in the adult trauma population: a ten-year experience. Can J Surg. 2006;49:386-390.

18. Meredith JW, Young JS, Bowling J. Non-operative management of blunt hepatic trauma: the exception or the rule. J Trauma. 1994;36:529-535.

19. Bège T, Brunet C, Berdah SV. Hollow viscus injury due to blunt trauma: a review. J Visc Surg. 2016;153:61-68.

20. Swaid F, Peleg K, Alfici R, Matter I, Olsha O, Ashkenazi I, et al. Concomitant hollow viscus injuries in patients with blunt hepatic and splenic injuries: An analysis of a National Trauma Registry database. Injury. 2014;45:1409-1412.

21. Brofman N, Atri M, Hanson JM, Grinblat L, Chughtai T, Brenneman F. Evaluation of bowel and mesenteric blunt trauma with multidetector CT. Radiographics. 2006;26:1119-1131.

22. Ekeh AP, Saxe J, Walusimbi M, Tchorz KM, Woods RJ, Anderson HL, et al. Diagnosis of blunt intestinal and mesenteric injury in the era of multidetector CT technology – are results better? J Trauma. 2008;65:354-359.

23. Kozar RA, Moore FA, Cothren CC, Moore EE, Sena M, Bulger EM, et al. Risk factors for hepatic morbidity following nonoperative management: multicenter study. Arch Surg. 2006;141:451-458.

24. Bala M, Edden Y, Mintz Y, Kisselgoff D, Gercenstein I, Rivkind AI, et al. Blunt splenic trauma: predictors for successful non-operative management. Isr Med Assoc J. 2007;9:857-861.